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CLAIMS

1. A method of monitoring a rotating synchronous electric machine (9), which comprises a rotor having a rotor winding and a stator having a stator winding, wherein the electric machine is cooled by at least one coolant, the method comprising the steps of

determining the stator winding current,

determining the stator winding voltage,

determining the rotor winding current,

measuring the coolant temperature, and

estimating the temperature in at least two positions in the electric machine (9) using a theoretical model of the electric machine, the determined current and voltage values, and the measured temperature of the coolant.

2. The method according to claim 1, which method further comprises the step of measuring the temperature in at least one point in the machine and wherein the temperature estimates are effected also in dependence on the measured temperature.

3. The method according to claim 1 or 2, wherein the rotor and the stator are divided into a number of zones, wherein the temperature is estimated for each zone.

4. A method of controlling at least one variable in a rotating synchronous electric machine (9), which comprises a rotor having a rotor winding and a stator having a stator winding, and the electric machine is cooled by at least one coolant, the method comprising the steps of

determining the stator winding current,

determining the stator winding voltage,

determining the rotor winding current,

measuring the temperature of the coolant, and

estimating the temperature in at least two positions in the electric machine (9) using a theoretical model of the electric machine and in dependence on the determined current and voltage values and the measured coolant temperature, and

controlling said at least one variable in dependence on the estimated temperatures and using the model of the electric machine.

5. The method according to claim 4, wherein controlling said at least one variable comprises controlling in such manner that at least one of the estimated temperatures is kept essentially constant.

6. The method according to claim 4 or 5, which method further comprises the step of measuring the temperature in at least one point in the stator and wherein the control of said at least one variable is effected also in dependence on the measured temperature.

7. The method according to any one of claims 4-6, which further comprises the step of measuring the temperature of the medium surrounding the electric machine and wherein the control of said at least one variable is effected also in dependence on the measured ambient temperature.

8. The method according to any one of claims 4-7, wherein controlling said at least one variable comprises controlling the current supplied to the rotor.

9. The method according to any one of claims 4-8, wherein controlling said at least one variable comprises controlling the supplied cooling effect.

10. The method according to any one of claims 4-9, wherein the electric machine is a generator and wherein controlling said at least one variable comprises controlling the supplied power.

11. The method according to any one of claims 4-9, wherein the electric machine is an electric motor and wherein controlling the electric motor comprises controlling the load.

12. The method according to any one of claims 4-11, wherein control is effected by means of a first allowable temperature and a second allowable temperature, wherein control is effected in such manner that said estimated temperatures are allowed to reach the first allowable temperature as a steady value and that said estimated temperatures are allowed to reach the second allowable temperature only for a predetermined period of time.

13. The method according to any one of claims 4-12, wherein the rotor and the stator are divided into zones, wherein the temperature is estimated for each zone.

14. The method according to any one of claims 4-13, wherein the temperature of at least one of a bus-duct (IPB), a generator circuit breaker (GCB) and a generator step-up transformer (GSU) is measured and used to control the generator output.

15. The method according to claim 14, wherein the temperature of at least one of the bus-duct (IPB), the generator circuit breaker (GCB) and the generator step-up transformer (GSU) is measured and used to control the cooling power for at least one of the bus-duct (IPB), the generator circuit breaker (GCB) and the generator step-up transformer (GSU).

16. A control apparatus for controlling a rotating synchronous electric machine, characterized in that the electric machine is cooled by at least one coolant, wherein the temperature of the coolant is measured, and the electric machine comprises at least stator current, stator voltage, rotor current, and coolant temperature

signal inputs, and that the control apparatus is arranged to transmit control signals for controlling at least one variable in the electric machine in dependence on the signals on the signal inputs and using a model of the electric machine, which model is used to estimate the temperature in at least two positions in the electric machine.

17. An apparatus for monitoring a rotating synchronous electric machine, characterized in that the electric machine is cooled by at least one coolant, wherein the temperature of the coolant is measured, and the electric machine comprises at least stator current, stator voltage, rotor current, and coolant temperature signal inputs and that the control apparatus is adapted to estimate the temperature in at least two positions in the electric machine in dependence on the signals on the signal inputs and using a model of the electric machine.

18. The apparatus according to claim 17, which further comprises a storage means, the estimated temperatures being stored in the storage means.

19. The apparatus according to claim 17 or 18, which further comprises a display means on which the estimated temperatures are displayed.

20. A power plant for generating electric power, comprising a turbine and a generator connected thereto, and a control apparatus as claimed in claim 16.

21. A synchronous compensator for synchronous compensation, which is controlled by means of a control apparatus as claimed in claim 16.

22. Use of a method as claimed in any one of claims 1-15 in a power plant for generating electric power, which power plant comprises a turbine and a generator connected thereto.

23. Use of a method as claimed in any one of claims 4-15 for controlling an electric synchronous motor.

24. A memory medium on which a computer program is stored for controlling a rotating synchronous electric machine, which comprises a rotor having a rotor winding and a stator having a stator winding, and the electric machine is cooled by at least one coolant, characterized in that the computer program when executed on a computer causes the computer to

receive an input signal containing stator winding current data,

receive an input signal containing stator winding voltage data,

receive an input signal containing rotor winding current data,

receive an input signal containing coolant temperature data, and

estimate the temperature in at least two positions in the electric machine using a theoretical model of the electric machine and the data of the received input signals.

25. The memory medium according to claim 24, wherein the program is further adapted to cause the computer to transmit an output signal for controlling the electric machine in dependence on the estimated temperatures when executed.